



Shelf life evaluation of formulated cookies from Hanjeli (*Coix lacryma-jobi* L.) and Moringa leaf flour (*Moringa oleifera*)

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ABSTRACT

Hanjeli (*Coix lacryma-jobi* L.) and moringa leaf (*Moringa oleifera*) remain underutilised despite their high nutritional value for food. In the present research, cookies made from hanjeli (*Coix lacryma-jobi* L.) with moringa leaf flour (*Moringa oleifera*) have been developed. Hanjeli cookies were measured for nutritional composition and shelf life assessment. The shelf life evaluation of hanjeli-moringa cookies was calculated using two approaches, which were accelerated shelf life testing (ASLT) methods with critical moisture content and the Arrhenius method. The results of the nutritional composition analysis showed that hanjeli-moringa cookies contain protein (9.14%), fat (24.67%), carbohydrates (61.62%), crude fibre (4.85%), and energy (505.01 Kcal). Using the Arrhenius method, the shelf life of hanjeli-moringa cookies was 95.46 days at room temperature and 97.63 days at 20 °C. Meanwhile, the shelf life of cookies using the critical moisture content approach was 170.57 days. Shelf life is influenced by initial moisture content, critical water content of the product, packaging surface area and permeability, saturated vapour pressure, and slope sorption isotherm curve. The formulated cookies have significant amounts of nutrients that are acceptable and safe for consumption, with guaranteed desirable sensory properties. The result of this study shows that hanjeli-moringa cookies can be used as an alternative food for people who need high energy in a practical way of serving or ready to eat.

1. Introduction

Cookies are a widely popular snack that is consumed by all ages, from children to adults. They are cherished because of their texture, comfort, appearance, and taste (Gouveia, Batista, Miranda, Empis, & Raymundo, 2007). Cookies also have an advantage over other baked products since they have low water content, a longer shelf life, and are affordable (Nagi, Kaur, Dar, & Sharma, 2012). Cookies can be used to increase nutrition for children, such as dietary fibre, protein, and other functional purposes, because they can be combined with various food ingredients or supplements (Sulieyman et al., 2019). Furthermore, cookies are convenient, cheap, and easy to digest.

Imported wheat flour is the main ingredient for bread and cookies. To reduce the dependency on wheat flour, an alternative to wheat flour

was needed. One of the alternative flours with high vegetable protein content is hanjeli flour. Hanjeli (*Coix lacryma-jobi* L.) is a cereal plant from the Gramineae family that can be used as food and feed (Nurmala, 2011). Hanjeli seeds can be consumed for staple foods such as hanjeli porridge or hanjeli rice (Masyitha, Mahdiyah, & Efrina, 2021). Hanjeli contains 67–76% carbohydrates, 14–20% protein, and other micro-nutrients. One hundred grammes of peeled hanjeli seed contains 10.1–15.0 g of water, 58.3–77.2 g of carbohydrates, 9.1–23.0 g of protein, 0.3–8.4 g of fibre, 0.5–6.1 g of fat, 0.7–2.6 g of ash, and 1500 kJ/100 g of energy (Masyitha et al., 2021). Hanjeli flour has the potential to be substituted for wheat flour because it has a longer shelf life. Compared to other cereals, hanjeli is higher in protein, fat, and vitamin B1 and also higher in calcium compared to sorghum, rice, and corn.

Moringa oleifera is thriving and cultivated in many countries, such as

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